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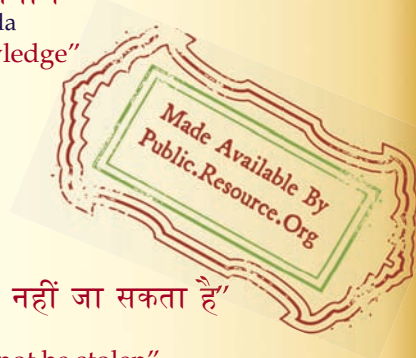
IS 4005 (1967): Specification for Tungsten Carbide for Mining Tools [MED 8: Mining Techniques and Equipment]



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*Indian Standard*  
SPECIFICATION FOR  
TUNGSTEN CARBIDE FOR MINING TOOLS

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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR TUNGSTEN CARBIDE FOR MINING TOOLS

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Indian Bureau of Mines, Nagpur

# *Indian Standard*

## SPECIFICATION FOR TUNGSTEN CARBIDE FOR MINING TOOLS

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 10 March 1967, after the draft finalized by the Mining Sectional Committee, had been approved by the Mechanical Engineering Division Council.

**0.2** In the preparation of this standard, considerable assistance has been derived from NCB 381-1963 issued by the National Coal Board, UK.

**0.3** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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### 1. SCOPE

**1.1** This specification covers four grades of tungsten carbide for use with mining tools, such as drilling bits and coal cutter picks.

### 2. DESIGNATION AND COLOUR

**2.1** The grades of tungsten carbide shall be designated as hard (H), medium (M), tough (T) and extra tough (XT) and tools on which these grades are used and which are required to be painted shall be coloured †red (signal red shade 537), †yellow (canary yellow shade 309), †blue (French blue shade 166) and white respectively.

### 3. COMPOSITION AND GRAIN SIZE

**3.1** The composition of the various grades of tungsten carbide shall be as specified in Table 1 and the grain size should lie within the limits specified (see Note 3 in Table 1).

\*Rules for rounding off numerical values (*revised*).

†See IS : 5-1961 Colours for ready mixed paints and enamels (*revised*).

## 4. HARDNESS TESTING

**4.1** The hardness test shall be carried out in accordance with IS : 1501-1959\* using a load of not less than 30 nor more than 50 kgf. The tests shall be carried out on the surface of the tip after removing 0.2 to 0.4 mm of material. The finish of the surface shall be fine enough to give a distinct impression for accurate measurement. To allow for variations in hardness measurement between different test centres, a range of 25 points above or below the specified hardness ranges (see Table 1) shall be permitted, provided that any grade supplied by a given manufacturer does not have a range of hardness greater than 100 points *HV*.

## 5. DEFECTS

**5.1** Tips shall be free from an undue amount of porosity, uncombined carbon and cobalt segregation. The tips shall be free from eta-phase.

**5.1.1** The surface of the tips shall be free from pitting.

**TABLE 1 TUNGSTEN CARBIDE — GRADE, HARDNESS AND COMPOSITION FOR MINING TOOLS**

(Clauses 3.1 and 4.1)

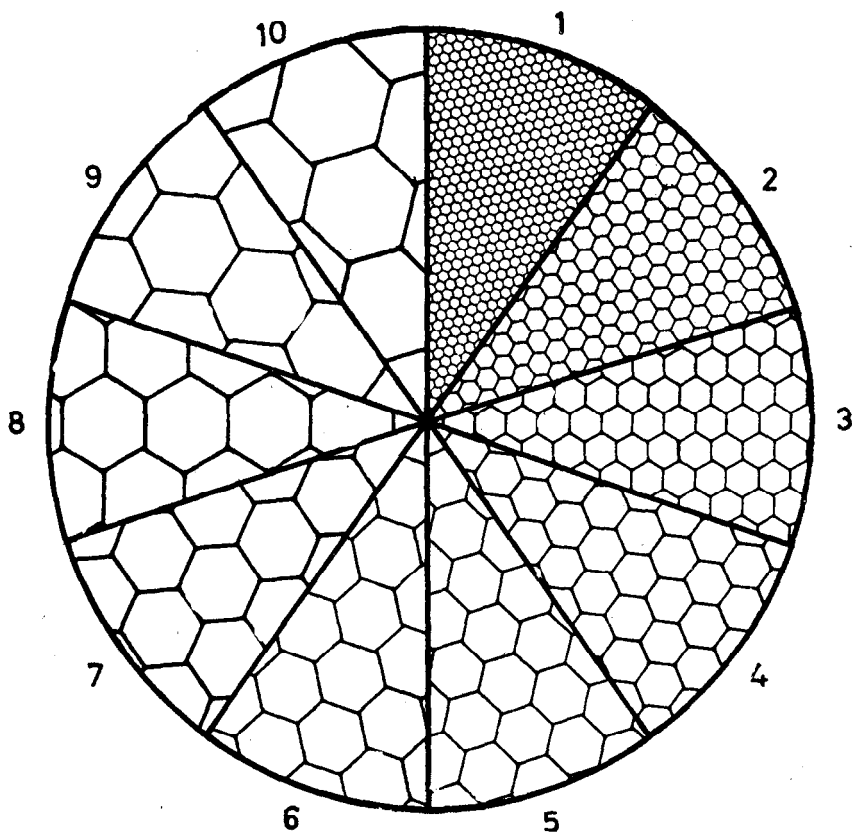
DESIGNATION, COLOUR AND GRADE	APPLICATION	HARDNESS RANGE	COMPOSITION AND PREDOMINATING GRAIN SIZE
H-red hard grade	Rotary drill bits	1 450 to 1 550 <i>HV</i>	7.0 to 8.0 percent cobalt, 1 to 3 $\mu$ m
M-yellow medium grade	Rotary drill bits	1 350 to 1 450 <i>HV</i>	9.0 to 10.0 percent cobalt, 1 to 3 $\mu$ m
T-blue tough grade	Cutter picks percussive bits and rotary drill bits	1 250 to 1 350 <i>HV</i>	8.5 to 9.5 percent cobalt, 3 to 5 $\mu$ m. For percussive bits the cobalt content may be reduced to 8 percent
XT-white extra-tough grade	Cutter picks percussive bits and rotary drill bits	1 150 to 1 250 <i>HV</i>	8.5 to 11.0 percent cobalt. The grain size shall be between 3 and 6 $\mu$ m so as to give the specified hardness

NOTE 1 — The hard and medium grade carbides shall not contain an undue amount of recrystallised grains of length greater than 5 microns.

NOTE 2 — By predominating grain size is meant the range of grain sizes of at least 60 percent of the area of the microscopic field.

NOTE 3 — The grain size figures are given for guidance only. The manufacturer is expected to produce grades having suitable grain-size distribution to give a hardness within the specified ranges. For grain-size measurement a convenient method is the use of the Miller diagram (see Fig. 1).

\*Method for Vickers hardness test for steel.



(Reproduced from 'Metal Progress' April 1953) (Originally in the General Motors Book of Standards Serial 4454-P, May 1950)

FIG. 1 CARBIDE GRAIN SIZE CHART FOR 1 TO 10 MICRONS,  
AT 1500 DIAMETER

## 6. IMPURITIES

6.1 The total impurities shall not exceed one percent and individually not exceeding the following:

Iron	0.5 percent
Titanium or other carbides (excluding tungsten carbide)	0.25 percent



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